REMARKS

This application has been reviewed in light of the Office Action dated February 10, 2006. In view of the foregoing amendments and the following remarks, favorable reconsideration and withdrawal of the objections and rejections set forth in the Office Action are respectfully requested.

Claims 1-25 are pending. Claims 1-12, 14 and 20 have been canceled, without prejudice or disclaimer of subject matter. Claim 13 has been amended. Support for the claim changes can be found in the original disclosure, and therefore no new matter has been added. Claim 13 is in independent form.

Claims 13-25 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the article "Anisotropic tuning behavior in epitaxial Ba0.5Sr0.5TiO thin films" (Hyun, et al.) and as unpatentable over Hyun, et al. in view of US Publication 2002/0155666 or U.S. Patent 6,930,339 (Higuchi, et al. '339 and '666). In the rejection, the Examiner has taken official notice that it is well known in the art of piezoelectrics to use specific crystal structures and orientation in different devices for the purpose of improving crystal/dielectric properties of the devices. With regard to the claims as currently amended, these rejections are respectfully traversed.

Independent Claim 13 as currently amended is directed to a piezoelectric actuator having a substrate and an epitaxial ferroelectric film on the substrate. The epitaxial ferroelectric film satisfies a relation $z/z_0 > 1.003$, where z is the c-axis lattice constant of the epitaxial ferroelectric film and z_0 is the c-axis lattice constant of a material constituting said epitaxial ferroelectric film in a bulk state. The epitaxial ferroelectric film also satisfies a relation $0.997 <$

$x/x_0 < 1.003$, where x is the a-axis lattice constant of the epitaxial ferroelectric film and x_0 is the a-axis lattice constant of a material constituting said epitaxial ferroelectric film in a bulk state. The epitaxial ferroelectric film has a thickness within a range of 100 nm to 10 μm, and includes a lead (Pb) atom and an oxygen (O) atom as constituent atoms.

In Applicants' view, Hyun, et al. discloses BST films grown epitaxially on MgO (001) and $LaAlO_3$ (001) subtrates by pulsed laser deposition using a KrF excimer laser with conditions of laser fluence, oxygen partial pressure and growth temperature of 2 J/cm^2, 300 mTorr and 750 degrees C. and anisotropic tuning behavior properties of the BST film on the MgO (001) and $LaAl)_3$ (001) was investigated. The film thickness was about 6000 Angstroms. The c-lattice constant of the BST film were 3.980 and 3.958 Angtroms on $LaAlO_3$ and MgO, respectively. Plane lattice constants were 3.946 and 3.962 Angstoms on $LaAlO_3$ and MgO, respectively, and the c/a ratio was 1.009 and 0.999 on $LaAlO_3$ and MgO, respectively.

In Applicants' opinion, Higuchi et al. '339 and '666 disclose a ferroelectric memory having a matrix-type memory cell array which has a superior degree of integration, in which the angularity of the ferroelectric layer's hysteresis curve is improved, the production yield is increased and costs are reduced. A peripheral circuit chip and a memory cell array chip are engaged onto an inexpensive assembly base 300 such as glass or plastic. In memory cell array chip 200, a ferroelectric layer is made to undergo epitaxial growth on to a Si single crystal via a buffer layer and first signal electrode. As a result, a ferroelectric memory can be realized which has improved angularity in the hysteresis curve and superior memory characteristics, production yield, and cost.

According to the invention, a piezoelectric actuator has an epitaxial ferroelectric film on a substrate. The epitaxial ferroelectric film satisfies a relation $z/z_0 > 1.003$ which improves the self-polarization so that the face spacing of the z crystal face in the bulk state is extended to obtain substantially better piezoelectric properties; a relation 0.997 _x/x_o_ 1.003 is provided to decrease the stress applied in a direction of the substrate within the ferroelectric film so that anti-fatigue properties of the ferroelectric film used in the piezoelectric actuator are improved; and a thickness within a range of 100 nm to 10μm is provided to prevent film breakage and degradation of piezoelectric properties. The epitaxial ferroelectric film has a lead atom and an oxygen atom as cnsttuents.

Hyun, et al. may disclose the structure of a BST thin film for use in phase shifters, filters, delay lines and tunable oscillators. The BST thin film in the Hyun, et al. article, however, is a high frequency usable paraelectric material with no self-polarization or suggested self-polarization improvement of the BST material. Further, Hyun, et al. is devoid of any suggestion that the BST materials they investigated for tuning behavior have any ferroelectric or piezoelectric properties. It is a further feature of Claim 13 that the epitaxial ferroelectric thin film has a lead atom and an oxygen atom as constituents which is not taught or suggested by Hyun, et al. for their BST material. Accordingly, it is not seen that Hyun, et al. which discloses a paraelectric BST thin film material to be used in tuner applications without suggesting any material with ferroelectric, self-polarization or piezoelectric properties that could provide the epitaxial ferroelectric film with the features of Claim 13. Higuchi et al. '339 and '666 disclose have been cited as teaching the use of a buffer layer in a ferroelectric memory structure with respect to cancelled Claims 3 and 4. The feature of a buffer layer, however, does not form any

portion of Claim 13. It is therefore believed that Claim 13 as currently amended is completely distinguished from Hyun, et al. taken alone and any combination of Hyun et al. and Higuchi et al. '339 and '666 and is allowable.

A review of the other art of record has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. These claims are therefore believed patentable over the art of record.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

REQUEST FOR CONSIDERATION OF PREVIOUSLY-FILED INFORMATION DISCLOSURE STATEMENT

Applicants filed an Information Disclosure Statement (IDS) on March 5, 2004. Applicants hereby respectfully request that the Examiner consider the art cited in the IDS filed on March 5, 2004 and return an initialed copy of the Form PTO-1449 submitted therewith indicating that the art cited therein has been considered.

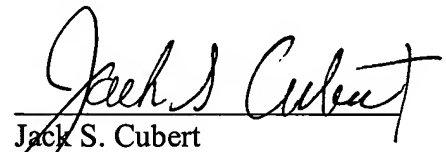
Applicants submit that this Amendment After Final Rejection clearly places the subject application in condition for allowance. This Amendment was not presented earlier, because Applicants believed that the prior Amendment placed the subject application in condition for allowance. Accordingly, entry of the instant Amendment, as an earnest attempt to

advance prosecution and reduce the number of issues, is requested under 37 C.F.R. § 1.116.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' attorney, Douglas W. Pinsky, may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



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